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DETERMINATION OF ABO BLOOD GROUP FROM THE LATENT FINGERPRINTS

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ABSTRACT

The present study was carried out to determine the ABO blood groups from the latent fingerprints and how it can be used as collaborative evidence, which can help in solving criminal cases. The study also tried to recognize an alternative approach for the problematic surfaces where the fingerprints cannot be uplifted or are smudged and are not viable for enhancement. The study also focussed on putting in perspective on the technique as limited information is available on detection of blood groups from fingerprints (sweat). Fingerprints of a total of 107 subjects were grouped by absorption-elution method. The study showed that 72% subjects were secretors of respective antigen in their sweat. Subsequently, the individual was also asked for blood drop for routine ABO blood test in order to compare it with the test result. The study may be useful in resolving or zeroing on a suspect in a criminal case.

Keywords: Absorption-elution, Latent fingerprints, Secretors, Sweat prints.

INTRODUCTION

ABO blood group system is clinically one of the most important systems. Karl Landsteiner (1900) discovered ABO blood groups at the University of Vienna in an attempt to clear the dilemma that why blood transfusions cause death sometimes and at the other times saves a patient. His student discovered AB blood group in 1902. Other than being used for transfusion purposes it is also being used by forensic scientists for solving disputed paternity cases, to identify and establish criminal identity and by anthropologists to study population variations.

The earliest use of immunology in fingerprint detection dates back to 1977 with the work reported by Ishiyama *et al.* (1977). Their investigation was centered on the use of antibodies and lectins to determine isoantigenic activity (blood types) from latent fingerprints. Although detecting latent fingerprints was not the main aim of the research, they were able to demonstrate the application of antibodies for fingerprint detection. Following on from this work, Pounds and Hussain (1987)

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further investigated the use of antibodies and lectins for fingerprint detection. Similar study was conducted by Champod *et al.* (2004) on whether latent print can reveal the blood group of an individual or not.

Blood group antigens are basically the terminal sugars present at the terminus of the long sugar chains called as Oligosaccharides that are attached to lipids on RBC membrane. Action of transferases controls the production of A, B and H antigen. Inheritance of ABO blood types was shown by Hirsfeld and von Dungern (1910, 1911).

Secretor status and its Importance

"ABH secretor," a popular term used, points towards the secretion of ABO blood group antigens in different and almost all body fluids, mainly saliva, sweat, tears, semen, and serum. If an individual is ABH secretor, specific antigen, depending on his/her blood type, is shown up in the body fluids. For example, Group A people will secrete A and H antigens, group O people will secrete only H antigen, etc. Out of the total population, about 80% are known as secretors because they possess genes that allow them to secrete their ABO blood type into their bodily secretions in free or unbound form (Kabat, 1956). The secretor status also provides individual with a degree of insulation against certain foods and microbes.

One of the primary differences in physiology between secretors and non-secretors has to do with qualitative and quantitative differences in components of their saliva, mucus, and other body secretions. Two alleles Se and se control secretor status, of which *Se* is dominant and *se* is recessive.

Latent Finger Prints

Fingerprints are classified as one of two types: visible or latent prints, with latent prints being the most commonly encountered (Fraser and Nora, 1975). "Latent fingerprint is a hidden record on materials formed by perspiration and oil from the internal finger and the ridges and furrows during friction or contact" (Swanson *et al.*, 1996).

The fact that a print is deposited when a finger, palm or foot touches a surface has been known for centuries. Soon, it came into picture that these characters or rubbing ridge patterns will start to be referred as a way to identify a criminal. Finger prints have become one of the most important and useful tools for identification purposes. Latent fingerprints (sweat stains) are often encountered in many forensic investigations like murders, sexual assaults, scuffles and can be found on weapons of offence, door panels, etc. In some medico-legal cases, like rape, robbery and hanging, blood stains may not be found but sweat stains may be found in some form or the other and which may be used for detecting blood group of a victim or suspected culprit. In such cases, sweat may be obtained from envelope flaps, doors or other articles.

MATERIALS AND METHODS

Method for detecting ABO Blood Group Substances from Sweat and other Bodily Fluids

Absorption-inhibition was developed by Siracusa (1923), and absorption-elution followed in the 1960s (Kind, 1960). Mixed agglutination is also a widely used method; many modifications and variants have appeared and the general procedures have been applied to other blood group systems. Although red blood cells rupture when a bloodstain dries, the A and B antigens that are present on the cell surface persist.

The Absorption-elution test: Absorption-elution technique is more common in forensic applications and is the method used in this research. It is explained here by taking the example of stains of type A blood group. In two different tubes having the stain extract, anti-A and anti-B are added. Anti-A will combine to the A antigens and when the stain is rinsed and washed with cold saline it will stay behind. After that the stain is heated at 56°C, which results in breaking the bond between the A antigens and anti-A antibodies. The solution into which the anti-A antibodies have eluted is then divide into half. In one portion A cells are added and to the other B cells. Agglutination will be observed with the A cells, and will confirm the kind of the original stain.

Method of Collecting the Saliva Samples

Saliva from 107 individuals was initially assessed for the secretor status by detecting the H antigen in saliva using the anti- H lectin. All the secretors and non-secretors were segregated on the basis of the presence or absence of the H antigen in saliva. All the samples of secretors were then subjected to absorption elution method.

Methodology for Secretor Status

Part I - Antibody Neutralization: In this method commercially available antiserum Anti-A, Anti-B, Anti-AB and Anti-H were added to saliva. If the individual possess secretor status, the antigens in saliva reacted with the antiserum thus neutralizing the antibodies in antiserum.

Part II - Agglutination Inhibition: When RBCs of appropriate blood group were added to the mixture, there was no antibodies left to agglutinate them if the individual is a secretor, because all the antibodies have already combined with the blood group antigens present in the saliva. The reaction will be negative for agglutination, but is interpreted as positive for secretor status.

On the other hand, there will be no blood group antigens present in the saliva sample of a non secretor individual; thus the antibodies in the antiserum will not be neutralized and will be free to react when the test cells are added. Therefore, agglutination is a negative test for secretor status.

Methodology for Absorption Elution technique

- Specimens/ fingerprints were affixed directly onto different glass slides.
- Anti-A, Anti-B, Anti AB and Anti-H was then used for sensitization on respective glass slides.
- The slide was immersed in ice cold saline so that the nonreactive antibodies would dissociate spontaneously.
- The slide was then given heat treatment (56°C) to disassociate the bond (elution).
- A corresponding known red cell suspension was added (0.8%).
- The slide was then observed for agglutination.
- The results were captured by a Digital Microscope.

Subsequently the individual was also asked for a blood drop for routine ABO blood test in order to compare it with the test result. Table 1 shows the method of scoring of results. The degree of agglutination and the interpretation of results are explained in Figure 1.

RESULTS AND DISCUSSION

Out of the 107 samples included in the study, 72% were secretors, which is higher than the studies conducted by Dacie and Lewis (1975), Pereira and Martin (1977) and Kimura *et al.* (1991). In Caucasians, approximately 80% are secretor and 20% are non-secretor. Parekh *et al*. (1994) studied 100 subjects for the presence of ABH antigen in saliva using absorption-elution method. They concluded that 79% subjects were secretors.

In the study, it was observed that maximum percentage of secretors were in the blood group 'A' (79%) , followed by the blood group 'B' (74%) , blood group 'O' (73%) and minimum percentage was in the blood group 'AB' (55.5%).

The present study also concludes that to detect ABO blood group antigens from sweat, absorption elution method can be useful. Compared to other tests it detects more true positive cases, has better sensitivity and shows greater measure of agreement with that of blood. The segregation of secretors and non-secretors also plays a significant role in determining the accuracy of the tests.

The determination of blood groups is useful for identification of the subjects or ruling out the identity especially in medico-legal cases because blood groups never change. This study may be useful in resolving or zeroing on a suspect in a criminal case. Even though the use of blood typing from latent finger prints does not evidently highlight the role of suspect involved as majority of people can have the same blood group but even then it can be used as collaborative evidence and can help in solving cases by linking of a suspect to the scene of crime.

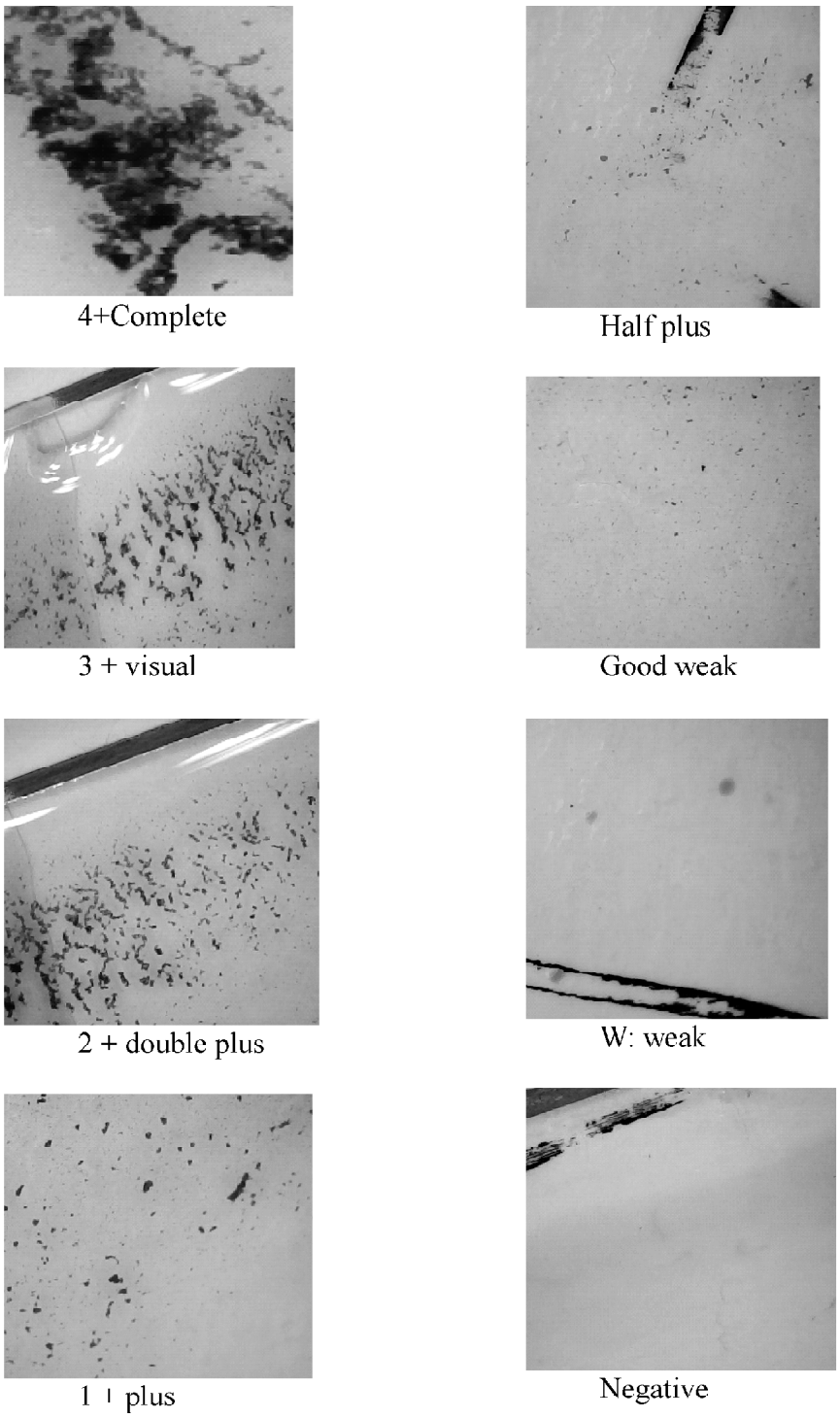

Figure 1: Agglutination and the degree of the result interpretation

Table 1: Scoring of Results

Scoring of Results	
4+ Complete	One complete mass of agglutinates, easily visible on the slide
3 + visual	Large separate masses of agglutinates, easily visible on slide, very few unagglutinated cells
2 + double plus	Small agglutinates, still easily visible on slide
1 + plus	A granular appearance, just visible on slide before microscopic examination, big clumps
Half plus	Smaller clumps, only detectable microscopically
gw: good weak	Small clumps
w: weak	Clumps, only detectable microscopically
– : negative	All cells free, evenly distributed, detectable microscopically

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